



RESECTION OF THE LIVER.

BY W. W. KEEN, M.D.



Fig. 1.



Dr. W. W. Keen's case of Resection of the Liver for Cystic Adenoma of the Bile Ducts. *a*, Tumor. *b*, Liver Substance. $\frac{3}{4}$ Natural size.

Fig. 2.



Section of the same tumor, showing its cystic character.

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ON RESECTION OF THE LIVER, ESPECIALLY FOR HEPATIC TUMORS.

WITH THE REPORT OF A SUCCESSFUL CASE, OF RESECTION FOR AN ADENOMA OF THE BILI-DUCTS, AND A TABLE OF TWENTY RECORDED CASES OF HEPATIC OPERATIONS.¹

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Mrs. J. G., was sent to me by Dr. B. S. Erwin, of Mauch Chunk, October 2, 1891. Age thirty-one; married at fifteen; six living children; four miscarriages, the last one about the middle of August, 1891; weight January, 1891, 135 pounds, August, 1891, 125 pounds. She has been subject to malaria for six years, escaping it, however, in the past year. Otherwise her general health was good until three years ago, when she began to have pain, weakness, flushing, painful and irregular menstruation, and soon passed into a generally broken-down condition. She has had neither diarrhoea nor dysentery.

About two years ago she first noticed a lump on the right side of the abdomen. This remained for several weeks, and then was lost sight of. It reappeared a year ago, at first about the size of a walnut, but growing slowly. Her pregnancy, which ended in a miscarriage in August, 1891, seemed to cause a rapid increase in its size. There has been at times retention of urine, and of late the quantity has been very small. She has never had any jaundice or especial digestive troubles. Pain and excessive discomfort have caused her to seek relief; she is broken down in general health and utterly wretched.

On examination, an oval tumor, about the size of a fist, was found on the right side of the abdomen, in the situation of the kidney, separated from the liver dulness by an area, three fingers broad, of distinct tympanitic resonance. By bi-manual examination pressure posteriorly is felt in front, and *vice versa*. The tumor was quite movable, moderately tender and of about the consistency of the kidney; no especially soft portion was found. The renal artery could not be detected. Vaginal examination showed no connection of the tumor with either uterus or ovaries. The perineum was somewhat torn posteriorly; the mouth of the uterus showed a moderate tear; and there was rather profuse leucorrhœa.

A microscopical examination of the urine was made by Dr. Kyle, who reports as follows: "Specific gravity, 1.010; leucocytes single and in casts; blood-casts (many); blood-corpuscles; epithelium, squamous and caudate; a few small renal epithelial cells; numerous crystals of uric acid, urate of ammonia, etc.; urea, 1.6%. Diagnosis probably a floating and diseased kidney. An exploratory operation was recommended.

Operation, October 9, 1891, assisted by Drs. Wm. J. Taylor and J. Chalmers DaCosta. Chloroform was used instead of ether, in view of the condition of the kidneys, as shown by the urine. I operated by a vertical incision in the right linea semilunaris, reaching nearly to the border of the ribs and nearly to the ilium. The incision was four and a half inches long. The moment the peritoneal cavity was reached a multi-

ple cystic tumor was seen. The surface was reticulated by partitions between the cysts, the cysts being on an average about the size of the little finger-nail, some larger and some smaller. The color was a light bluish-white (see Plate). The moment the hand was introduced into the abdomen it was discovered that the tumor had no connection with the kidney. The right kidney appeared to be somewhat smaller than normal but was in its right place. On drawing the tumor out of the abdomen, it was instantly seen to be connected with the liver, involving its extreme right border. In size it was three and a half inches vertically and nearly the same transversely. At its base, where it joined the liver substance, it was two and a half inches thick. It was evidently a localized tumor. Just at its internal border was the gall-bladder, which was normal, but so close to the tumor that I dissected it loose for half an inch in order to operate with greater ease. A few small vessels required ligation at this point.

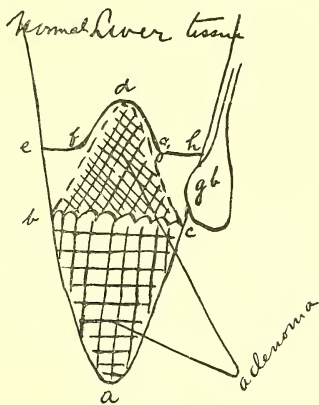


FIG. 1.

Diagrammatic Section of the Liver and the Adenoma. *abc*, the limits of the tumor as seen externally; *bdc*, its wedge-like prolongation into the liver; *efg*, lines of section of liver substance by the caudate; *gfh*, the portion enucleated by the finger-nail; *gh*, the gall-bladder; *dfe* and *dgh*, the "flaps" left after removal of the neoplasm.

Having gone so far as to open the abdomen and having found the source of the trouble, and the tumor appearing to me to be possibly, and I might even say probably, non-malignant, I determined to attempt its removal. My first idea was to ligate the thick border of attachment, where liver and tumor were continuous, and then to divide this pedicle, if it could properly be called a pedicle, by the Paquelin cautery. I therefore put one stitch directly through the liver-substance next the gall-bladder, induced especially to begin here by reason of a very large artery which had been exposed but not wounded during the separation of the gall-bladder from the liver. Having tied the liver here, I tried the effect of the Paquelin cautery, and was so well satisfied with it that I made no further attempt to ligate the liver-substance but continued cutting with the cautery. As I cut, four very large veins were laid bare, and were ligated before being burned through. When I had cut about half-way through in depth, I

¹ Read before the Surgical Section of the Suffolk District Medical Society, March 2, 1892.

found that my cautery knife was cutting into cysts of the neoplasm, and that the latter extended as a wedge into the liver to a greater distance internally than was apparent from the outside (Fig. 1). Accordingly I made an attempt to strip the liver-substance from the tumor with my thumb nail, and found that I could do so with perfect ease and without serious hæmorrhage. This enucleation left the tumor attached to the liver at its posterior border only. I then burned through the posterior attachments of the tumor with the cautery. A few points required extra touching with the dull red platinum point. The liver-stump, roughly speaking, resembled that of an amputation with its two flaps. These two edges or flaps were then approximated by five sutures passed deeply through the substance of the liver.

The intestines had been protected meanwhile by a large flat sponge. This had kept the most of the blood out of the belly cavity, and the amount lost I estimated at six to eight ounces. The belly cavity was flushed with hot water, and the wound closed after inserting a glass drainage-tube. A sublimated wood-wool dressing was now applied, and the patient put back in bed in very fair condition. Within fifteen minutes her lips had assumed a good, though pale, red color. The operation lasted about an hour.

December 10, 1891. After the operation, two doses of one-eighth of a grain of morphia hypodermatically relieved her pain, and one of one-fourth of a grain of cocaine by the stomach checked her vomiting. From the drainage-tube in the first twenty-four hours about three ounces of bloody serum were removed, in the second twenty-four hours less than one ounce; and therefore at the end of forty-eight hours, the tube was removed. No bile or bile-stained fluid was seen at any time. The bowels were moved on the second day by drachm doses of sulphate of magnesia, the stools being then and afterward of a normal brown color, without any visible disturbance of the hepatic function.

The temperature on the night after the operation rose to 101.2° , on the two following days to 100° , and after that was not above 99° , excepting during what was apparently a malarial attack, which began eleven days after the operation and lasted four days. During this attack the temperature rose to 101.2° again. The stitches were removed at the end of a week. In fact, with the exception of the malarial attack, her recovery was an uninterrupted one. I kept her in bed for about three weeks in order to avoid any possibility of ventral hernia, and also, as I had no experience in such operations on the liver, I feared that either from the charred surfaces or from want of union of the tissues, followed by escape of bile into the peritoneal cavity, there might be some digestive or other abdominal difficulty. No such trouble, however, appeared, and she went home forty-two days after the operation, entirely well. I heard from her in February, 1892, and she has continued in the best of health, with no disturbances of either liver, stomach or bowels.

The tumor was entirely strange to me, and unlike anything I had ever seen before. Naturally my first idea was that it might be made up of echinococcus cysts, but certainly unlike any I had ever met with. I therefore gave it to Dr. W. M. L. Coplin, Adjunct Professor of Hygiene in the Jefferson Medical College, who

was assisted by Dr. D. Bevan in its examination. Upon receiving their report, I found that the tumor was exceedingly rare, and interesting pathologically as well as surgically. Accordingly I sent it to Prof. W. T. Councilman of the Johns Hopkins Hospital, who also has kindly sent me the results of his examination. I append both reports, as the examinations were made entirely independently of each other, and their concurrences are therefore the more valuable.

Professor Coplin has also, at my request, prepared a few remarks on the pathology of hepatic cysts of new formation, excluding hydatid cysts.

PATHOLOGICAL REPORT OF PROF. COPLIN AND DR. BEVAN.

"The tumor is ovoidal in outline, and measures 9 cm. ($3\frac{1}{2}$ in.) in width, 11.5 cm. ($4\frac{1}{2}$ in.) in length, 4.5 cm. ($1\frac{3}{4}$ in.) in thickness. Weight, 113 gm. (3 oz., 255 gr.). Surface smooth, with slight tuberosity elevations corresponding to cysts located beneath. The surface of removal irregular, showing at points attachment of liver-tissue. Several very large veins are to be seen entering at various points. Upon the external surface an incision has been made disclosing numerous cysts varying in diameter from 1 mm. or less to 20 mm., and containing a milky, flocculent fluid about the consistency of blood-serum. Under the microscope this contained white blood-corpuscles, and a few red, these probably having gained ingress in the opening of



FIG. 2.

Cells from the Cystic Fluid. The figure on the extreme right represents the size of red blood corpuscle.

the tumor. There was also present a much larger cell, at least three times the size of a white blood-corpuscle, irregular in outline for the most part, although a few could be seen with a sharply defined wall and round in outline (Fig. 2). Many of these bodies contained well defined nuclei, although these were by no means constantly present. When nuclei was present, the peri-nuclear protoplasm was always granular; those having no nuclei were finely granular, at points containing vacuoles. On the warm stage of the microscope these cells did not evince any movement; however, their varying contour is highly suggestive, and a more positive result might have been attained had the test been made early after removal.

"Many of the cysts communicate by small round openings through the thin part of the wall; these communications are not, however, universal, as the entire contents cannot be evacuated by the single incision, and fluid thrown in one cyst will not distend more than three or four other cysts. The walls of the cysts vary greatly, at points being extremely thin; elsewhere they may be found fully 6 mm. to 10 mm. in thickness. The density of the tissue between the cysts also varies, being for the most part firm and elastic.

"Microscopic examination reveals a cylindrical cell epithelial lining, at points projecting into the cyst cavity, and closely resembling dendritic growths, as seen in certain forms of papilloma (Fig. 3). It is, however, to be remembered that sections of gland acini would give exactly this appearance. The cylindrical cells are

high and not ciliated. They are arranged upon a fairly well defined basement membrane, back of which is found a varying thickness of connective tissue containing blood-vessels, unstriated muscular tissue and fibrous tissue, in varying amounts and stages of growth, at points still made up of embryonic cells. The sections do not show any hepatic cells present in the tumor itself.

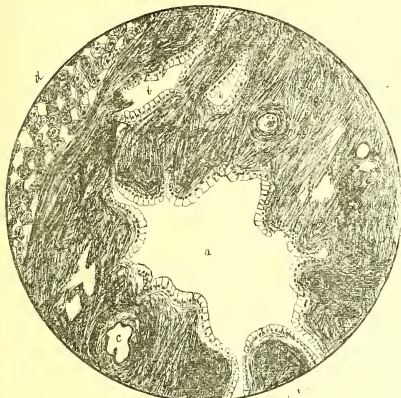


FIG. 3.

a, Large cyst lined with columnar epithelium; b, small cysts; c, blood-vessel with greatly thickened walls; d, liver cells with dilated vessels between them.

Bacteriological Examination.—Sections stained by Gram's method, tissue stained by picro-carmin, show cocci present in large numbers. These are arranged for the most part in zooglæ around the blood-vessels and lymph-spaces; as single cocci and in short chains, they are also to be found between the epithelial cells and their basement membrane. The surface of the tumor being seared with cautery and a small cyst opened by a sterile needle, culture tubes were inoculated. These gave a pure culture of cocci, growing rapidly on agar, as an ashen gray opaque growth, slightly elevated on the surface and penetrating the medium as a dense cloud and not liquefying the surface. They stained well both by Gram's method and Loeffler's alkaline stain. They measure 1μ in diameter, that is, they are slightly larger than the *staphylococcus albus*.

The patient had had neither attacks of dysentery nor of diarrhœa from which any infection by these micro-organisms could be accounted for.

REPORT OF PROF. W. T. COUNCILMAN.

"The tumor is oval and somewhat flattened. The surface is smooth, but uneven from numerous rounded projections. The surface of removal is irregular, the edges here and there showing the marks of the cautery. This surface consists of liver tissue with considerable connective-tissue. Several large vessels enter the tumor at this point.

"On section of the tumor, it consists of numerous cysts of varying size and of irregular shape. Many of these open into one another, and from the surface of one cyst there are deep projections into the sur-

rounding tissue. The cysts vary in size from 1 mm. (or smaller) to $3\frac{1}{2}$ cm. They are relatively more frequent and larger in the periphery of the tumor. They contain (after hardening in alcohol) a soft, white, curdy mass. The wall is smooth and tolerably thick. The centre of the tumor and the tissue everywhere separating the cysts is dense and fibrous.

"On microscopic examination the cysts are lined with high, cylindrical epithelium, which in many places projects in small papillomatous formations within the cyst. None of the epithelial cells are ciliated. The tissue between the cysts, and forming the stroma of the tumor, is dense connective-tissue with numerous bands of non-striated muscular fibres. In the stroma there are some places rich in granulation cells.

"The tumor is one of the rare cystic tumors of the liver, and evidently originates from the bile-ducts, and most probably from the large vasa aberrantia found on the edge of the liver. The irregular shape of the cysts is due to their rupture into one another."

Professor Coplin has kindly furnished the following:

REMARKS ON ADENOMATA.

"Of the cystic adenomata of the liver we know very little, and the confusion is deepened by the fact that the German writers Ziegler, Klebs and others, consider cylindrical-celled carcinoma as adenoma, and draw little or no line of differentiation except that of infiltration. The earliest attainable literature is in Klebs who quotes E. Wagner² as having observed in the liver enlargements, the structure of which resembled the so-called glandular tumors of the mammary gland; Klebs is inclined to think that all adenomata of the liver are malignant, and does not refer to any that at all resemble the present case. Ziegler states that adenoma of the liver may be made up of tubular glands instead of lobules.³ Although he lays no stress on these tumors, save in their rarity, he gives a most typical cut presenting the exact histological structure of the present case, and designates the growth as papilliferous cystadenoma. As to the exact origin of these growths, nothing is known. Whether they arise from the ducts or from the liver-cells within the lobules, as Rindfleisch thinks, cannot be demonstrated. The reported cases do not appear at all like the present one; they are solitary cysts disseminated throughout the organ, lined for the most part by pavement epithelium, rarely by cylindrical cells, more rarely by ciliated cells.⁴ In the latter case, one can hardly call it an adenoma, or even a cyst."

Dr. David Bevan has kindly made an excellent drawing from a section (Fig. 3) and has furnished me with the following description of the microscopical appearance of the tumor:

"The stroma is composed of white fibrous connective-tissue, in which small openings are perceived, presumably (?) beginning cysts. Occupying the centre and extending to the right lower part of field, is observed a large cyst (a) lined with columnar epithelium. The margin of the cyst is very irregular, a number of small papillæ extending into it. In its extreme lower end is noted a papilla of considerable size; above the large cyst are two smaller ones (b), to the right of which is an artery with greatly thickened wall. Still further to the right is a bundle of unstriated muscular

² Arch. d. Heilk., 1861, S. 471.

³ Path. Anat. and Pathogenesis, Art. 167.

⁴ Friedreich: Virchow's Archiv.

tissue and a blood-vessel. To the left of the central cyst is another bundle of unstriated muscle. Just beyond this is the limit of the neoplasm where the fibrous tissue is very dense, sharply defining it from the liver proper (*d*). In the lower left of the field (*c*) is a large artery with enormously thickened coats. The lumen is greatly altered in form. The liver-cells (*d*) are changed in shape, and the capillaries between them much enlarged."

Dr. Robinson S. Westcott has kindly prepared the accompanying table, which, I believe, contains all the cases of resection or amputation of the liver which have been recorded up to this time. Based upon this and upon my personal experience in my own case, I shall add a few

REMARKS.

(1) *Date and locality of operation.*—Of the 20 cases two are American, and the others European, chiefly German and Italian. I have not found any English case. The first American case was reported by Tiffany, of Baltimore, in 1890 (No. 15). The first recorded case was by Langenbuch, in 1888, less than four years ago.

(2) *Age.*—This varied from twenty-one to fifty-eight years. The decade from twenty-one to thirty furnished six cases; that from thirty-one to forty, five cases; that from forty-one to fifty, three cases; and two were between fifty-one and sixty.

(3) *Sex.*—In striking contrast to age, sex is evidently a potential factor. Of the 19 cases in which this is given, three were men and 16 women. Taken in connection with the well recognized greater frequency of gall-stones in women, one can scarcely avoid attributing both affections to the pressure upon the liver, resulting from tight-lacing. In fact, Langenbuch's case (No. 1) was not really one of a tumor of new formation, but was a portion of the liver itself in process of gradual separation from the main organ, presumably by the pressure of the clothing; and Lauenstein's (No. 11) probably a similar one.

(4) *Size and weight.*—The tumors and portions of liver removed have varied in size from that of a small nut up to the "size of three fists," or of "a man's head." In weight, they have been as large as $3\frac{1}{2}$ oz., as in the present case, to $11\frac{1}{2}$ oz., and even 3 lbs.

(5) *Diagnosis.*—Of the twenty cases nearly all were incorrectly diagnosed. In three it was thought that there was a tumor connected with the liver, and in one with the gall-bladder. In others, the diagnosis had been a tumor of the pancreas, the mesentery, the omentum, the pylorus, the colon, the ovary, or the kidney. In my own case my diagnosis was a floating and probably diseased kidney. The reciprocal pressure, so easily felt in the loin and anteriorly, the mobility of the tumor, its apparent resemblance to the kidney in size, the blood-casts, leucocytes and renal epithelium in the urine, combined especially with the fact that there were over two inches of distinct tympany between the tumor and the border of the liver, all looked towards the kidney and away from the liver as the organ involved. I find that a similar tympany is distinctly stated to have intervened between the tumor and the liver in six cases of the twenty, and probably existed in some of the others.

While this physical sign should have its due weight, the presence of tympany must not be deemed to exclude tumor of the liver.

The symptoms, also, are not usually at all characteristic of the hepatic origin of the tumor. There has been no jaundice and no digestive symptoms other than those which would naturally arise from almost any abdominal tumor.

(6) *Variety of tumor.*—In two cases the part resected was a constricted and partly separated portion of the liver, and was not therefore, properly speaking, a tumor. Of the remaining eighteen, one-half (nine) were echinococcus and hydatid cysts; three were cases of cancer; three of syphilitic tumor; and one each of sarcoma, small calculi and adenoma of the bile-ducts.

But the chief interest naturally centres in the fact, the methods and the results of removal, since this constitutes an entirely new chapter in abdominal surgery.

(7) *Can any large portion of the liver be removed without a fatal result?*—The results of experiments upon animals rendered it probable, not only that in man also a portion of the liver could be removed without so seriously interfering with its function as to be incompatible with life, but that a very considerable portion could thus be removed without unreasonable danger. Ponfick⁶ showed that in the rabbit the removal of a quarter of the liver caused a slight deterioration in the general condition of the animal; removal of one-half was followed by much more serious results, which, however, passed off within a few days: even removal of three-quarters of the liver could be recovered from, though the prostration was very severe at first; but that removal of more than this amount (three-quarters) was always fatal. He showed, also, that not only could the animal bear the loss of a large part of the liver, but that there was a reparative power in that organ by which new hepatic tissue could be produced.

Later,⁶ Von Meister, from his own experimental observations has confirmed some of the results previously obtained by Ponfick, of the remarkable degree of reparative power exhibited by the liver, a power which may exist in other glands in greater or less degree, and he has even gone further. He found that in the dog and cat, as well as in the rabbit, the removal of even more than three-fourths of the liver was not followed by any serious consequences, and that within the space of thirty-six days repair had advanced to such an extent that the weight of the organ was regained. This regeneration is effected partly by hypertrophy of the hepatic cells, but mainly by their hyperplasia; but new lobules are not formed, and biliary ducts as well as blood-vessels share in the new formation. Observations were also made upon the effect of extirpation of such large portions of the liver upon the excretion of urea. It was found that the total quantity of nitrogen notably diminishes, but not in proportion to the nitrogen of the urea, so that the proportion of the latter to the whole nitrogenous excretion is decreased. On the other hand, the amount of extractive matters is increased, and their nitrogenous constituents appear in greater proportion than normal to the total nitrogen. The diminution in urea is proportionate to the amount of liver-substance removed, total extirpation of the organ leading to a very marked decrease in urea. It was further found that after partial extirpation—within a period of from eleven to fifteen days—the quantity of urea rises until it once more attains the normal degree.

⁶ Lancet, 1891, ii, p. 1409.

⁶ Lancet, 1890, i, 821; and *Böllage z. Centralbl. f. Chir.*, 1890, 67.

TABLE OF TWENTY REPORTED CASES OF REMOVAL OF TUMORS OF THE LIVER.

COMPILED BY THOMPSON S. WESTCOTT, M.D., OF PHILADELPHIA.

No.	Reporter and Reference.	Sex.	Age.	Duration, Nature and Size.	Method of Removal.	Treatment of Liver Stump.	Result.	Remarks.
1	Langenbuch. Berlin klin. Woch., 1888, No. 3, p. 37.	F.	30	Eight years. A constricted part of left lobe, supposedly due to corsets worn until tumor began to be painful and was first observed; weight, 370 grammes.	Ligamentous connection divided into several portions and ligated.	Returned to abdomen.	Recovery.	Abdomen reopened for internal hemorrhage a few hours after operation. Vessels ligated and stump returned. Exploratory operation. Diagnosis of pancreatic tumor, movable tumor of mesentery or echinococcus of liver. Possibility of a tumor of liver developed by lacing.
2	Loreta. Memorie della R. Accademia delle Scienze dell' istituto di Bologna, 1886-1888, serie quarta, tomo viii, p. 581.	M.	40	Two years. Appeared externally the size of a foetal head. Echinococcus cyst. Underlying tissue of left lobe infiltrated for an extent of 15½ by 14 centimetres.	This area was included between an intersecting continuous suture, drawn tightly and tied. Removal by bistoury.	Hæmorrhage checked and edges of Glisson's capsule at edges of wound on convex and concave surfaces stitched together and to abdominal wall. Collodion and iodoform dressing.	Recovery.	Diagnosis: Suspected echinococcus.
3	Garré. Beitrüge zur klin. Chir., 1888, Bd. iv, p. 181; abst. in Annals of Surgery, xi, 1890, p. 127.	F.	44	Echinococcus cyst, with pedicle.	Pedicle tied and touched with thermocautery.	Disinfected and returned to abdomen. No drain.	Recovery.	Tympanitic between liver and tumor; not believed to be connected with liver, but probably mesenteric or omental.
4	The same.	M.	50	Six months. Hazle-nut-sized cancerous nodule of right lobe, metastatic from a larger tumor of abdomen.	Excision by knife.	Seared with thermo-cautery and returned.	Recovery.	Main tumor not removed, its point of origin not being determined. Diagnosis before operation: Carcinoma of mesentery.
5	Pozzi. Gazette Méd. de Paris, June 30, 1888; also Cong. Franç. de Chir., Proc. Verb., 1888, p. 545.	F.	34	Large echinococcus cyst.	Scissors.	Ligature, thermo-cautery and suture, with suture of liver wound in abdominal wound, and drainage.	Recovery.	Discharge of bile and renewed liver tissue through the drain. Fistula closed.
6	Ruggi. Dell' Epatectomia Parziale nella cura delle cisti d'echinococco, Bologna, 1889.	F.	22	Two years. Double echinococcus cyst, in oblique diameter about 19 cms., springing from under surface; a portion of liver 18 by 10 cms. excised.	Excision. Vessels tied with catgut.	Edges of cavities sutured to peritoneal edge of abdominal wound, and treated externally.	Recovery.	Diagnosis of echinococcus of kidney, as the tumor had no apparent connection with liver, being separated by a tympanitic area (intestinal loop). Free discharge of bile through wound.
7	Boggi. Wiener med. Presse, No. 21, 1889; abst. in Am. Jour. Med. Sciences, Sept., 1889.	F.	..	Double echinococcus cyst, weight 3 pounds.	Enucleated. Portion of liver parenchyma 3 in. long resected.	Edges of liver cavity secured in abdominal wound.	Recovery.	
8	Volitz. Hospitals Tübingen, 1889, 22-610-612; in Annals of Surgery, 1890, xi, p. 288.	F.	21	Tumor 9 years, rapidly increasing after confinement 11 mos. before. Echinococcus cyst, size of child's head, extending below a line from one iliac spine to the other, and above continuous with liver.	Excised with a portion of greatly atrophied liver tissue.	Wound united by a continuous suture so as to form a crest-like elevation. Abdominal wound closed.	Recovery.	
9	Wagner. Bellage zur Centralbl. f. Chirurg., 1890, p. 68; also Revue de Chir., 1890, x, p. 767.	F.	43	Four years. Right lobe, probably syphilitic. Three fists' size, with pedicle.	Division after ligation.	3 x 10 to 12 cms. Returned to abdominal cavity.	Death, same day.	Gall-bladder could not be found.
10	Deeds. Union Médicale du Nord-est, 1890, No. 3, p. 97.	F.	23	Seven or eight years. Hydatid cyst, with pedicle, 3 cms. long by 1 cm. broad, arising from the sharp border of left lobe, and enveloped by two folds of the gastro-hepatic omentum.	Pedicle at first incised by cautery, but on account of hæmorrhage ligated by two turns of catgut and removed by scissors.	Lavage. Abdominal incision closed.	Recovery.	Diagnosis of cyst of ovary, as it appeared attached in region of right ovary. It lay in front of stomach and behind transverse colon. Seemed independent of liver, and no hydatid frenitum felt.
11	Lanenstein. Bellage zur Centralbl. f. Chirurg., 1890, p. 73.	F.	..	Large freely-movable lobule attached to lobus Spigelii.	Death, 12th day.	Sepsis.
12	Tillmanns. Bellage zur Centralbl. f. Chirurg., 1890, p. 73.	?	..	Large syphiloma.	Operation in two stages. Thermo-cautery.	Extra-peritoneal.	?	Diagnosis of liver tumor.
13	Hochenegg. Wiener klin. Woch., 1890, No. 12; in Centralbl. f. Chir., 1890, p. 767.	F.	58	Nine mos. Under surface of liver, portion of substance infiltrated, 3.5 by 4.5 cms. Carcinomatous.	Excision by knife.	Attempted suture, but sutures tore out. Stump fixed in abdominal wound.	Recovery.	Diagnosis: Cancer of pylorus or colon. Tympanitic between tumor and liver. Gall-bladder removed.
14	Skifosovsky. Wratsh. No. 27, 1890, p. 594; in Annals of Surgery, xlii, 1891, p. 151.	F.	24	Seven mos. Fibro-myoma lipomatodes sarcomatodes. Size of man's head, with isthmus 2½ fingers' breadth.	Isthmus tied, liver fixed to abdominal wall, and tumor amputated.	Stitched in abdominal wound.	Recovery.	Diagnosis: Probable tumor of omentum or mesentery, not of liver, as note between liver and tumor was tympanitic.
15	Tillman. Maryland Med. Journal, 1890, No. 23, p. 531, and International Med. Mag., April, 1892.	M.	25	Six mos. Tumor noticed to left of middle line and slightly in epigastrium; nodule on convex surface of liver; contained a small amount of fine biliary calculous matter.	Excised with curved scissors, and surface cauterized. Abdominal incision of 5 in. in line of fibres of left rectus abdominis.	Cavity size of a walnut left, walls of which were cauterized.	Recovery.	Diagnosis not made. Operation exploratory.
16	Hochenegg. Wiener klin. Woch., 1890, No. 52, p. 1008; in Centralbl. f. Chirurg., 1891, No. 18, p. 365.	F.	27	Gumma, 8 cms. Tumor imbedded in capsule, and covered with normal liver substance.	Contour of tumor burned through with cautery, and tumor enucleated. Hæmorrhage stopped by gauze and pressure.	Fixed to abdominal wall.	Recovery.	
17	Tausch. Brit. Med. Journal, 1891, i, 81.	F.	..	Hydatid cyst.	Total extirpation. Excision of a portion of liver.	Wound closed with sixteen sutures, partly silk and partly catgut.	Recovery.	Free hæmorrhage from cut surface controlled by catgut ligature. Operation followed by no rise of temperature.
18	Alkeke. Centralbl. f. Chir., 1891, No. 6, p. 115.	F.	31	Two years. Cancer left lobe size of fist, pedicle 20 centimetres in circumference.	Pedicle sutured to abdominal opening, tumor protruding.	Surrounded with iodoform gauze and tied with rubber drainage-tube progressively tightened.	Recovery.	Thermo-cautery used at first; abandoned on account of bleeding. Pedicle divided with cautery on ninth day.
19	Terrillon. Rapport de Duplay, Bulletin de l'Académie de Médecine de Paris, 1891, xxv, p. 75.	F.	53	Six years. Following supposed injury. Multiple hydatid cysts, involving a portion of the liver about the volume of two fists.	Affected portion, clearly demarcated from healthy tissue, surrounded by rubber tube.	This artificial pedicle measured 24 cms. in circumference. Mass fixed to lips of incision by sutures. Iodoform dressing. Strangulated part withered; resected on seventh day.	Recovery.	Diagnosis of distended gall bladder made by several other surgeons.
20	Keen. The present case.	F.	34	Two yrs. Increased during pregnancy. Size 9 by 11½ cms., and 4½ cms. thick at base; weight 113 grms. (3½ oz.); adenoma of bile-ducts.	Thermo-cautery and enucleation. Four very large vessels tied with catgut.	Edges of liver wound united by five silk sutures. Stump returned to abdomen.	Recovery.	Diagnosis of floating and probably diseased kidney. Tympany between tumor and liver.



(8) *Will not the escape of the bile produce dangerous or fatal peritonitis?*— Even the escape of bile into the peritoneal cavity, which would naturally excite great apprehension, seems to be more of a theoretical than a practical objection. In only two cases of the twenty was any such discharge of bile observed. This gave no trouble, as it escaped externally in both instances. Pavy has stated that no harm arose from such a free escape of the bile into the peritoneal cavity in his experiments in dogs; and Lane⁷ has reported a case of probable rupture of the gall-bladder, in which, after five weeks, he evacuated over three gallons of bile-stained fluid, yet the patient recovered. Moreover, there is probably a considerable escape of bile into the abdomen in some of the cases of cholecystotomy which recover; yet it is an accident that should be avoided if possible.

This fear of the escape of bile led me to insert a glass drain in the present case. Part of the tumor was removed by enucleation and part by the cautery; and I feared that either surface or both would allow of the escape of bile since the sutures did not, of course, accurately approximate the surfaces. The result showed that the precaution was needless, and after forty-eight hours the drain was removed, no bile or bile-stained fluid having been observed.

It being conceded, then, that more or less of the liver could be removed without sacrificing life, either primarily or by its after consequences, the next point is

(9) *The method of removal and especially the means for the prevention of hæmorrhage.*— In my own case there was absolutely no trouble in this respect. The base of the tumor was severed by repeated small touches of the cautery-point; the large vessels were all seen and ligated before their division by the cautery; and the small ones either did not bleed or ceased bleeding upon slight touching with the dull red platinum point or after pressure with a sponge dipped in hot water. From the portion that was enucleated by the thumb-nail, absolutely no hæmorrhage other than slight oozing took place, and I would especially commend this procedure. It was simple, easy and rapid. The methods adopted in the other nineteen reported cases have been various; and often, as in the present case, two or more have been combined with great advantage; thus the tumor has been excised; ligated and excised; ligated and cauterized; ligated, excised and cauterized; and in three cases was enucleated.

(10) *Treatment of the stump.*— In nine cases, after completion of the operation by the methods already named, the stump was returned to the abdominal cavity. In three cases the lips of the hepatic wound were first sutured, in one of them (No. 17) with as many as six-

teen sutures. Of these nine all but one recovered. In six cases (Nos. 2, 5, 6, 7, 13, 16) the stump was sutured in the abdominal wound at the close of the operation. In two (Nos. 5, 7) there was a free discharge of bile through the wound. All of these recovered. In four cases (Nos. 12, 14, 18, 19) the liver was attached to edges of the abdominal wound before the removal of the tumor. In one case (No. 14) ligation of the pedicle, fixation to the abdominal wall and immediate amputation of the tumor was practised; but in the other three a true extra-peritoneal treatment was carried out. In one case (No. 12) it was done in two stages, that is, primary suture to the abdominal wall and a later amputation. Lücke (No. 18) sutured the pedicle to the abdominal wall, surrounded the protruding tumor with iodoform gauze, and tied the pedicle with a rubber-tube, which was gradually tightened. Terrillon (No. 19) made an artificial pedicle (24 cm., [$9\frac{1}{2}$ in.,] in circumference) by constricting the attachment by rubber-tubing and sutured it to the abdominal wound, the tumor protruding externally. Under an iodoform dressing this gradually withered, and was removed on the seventh day. All of these four extra-peritoneal cases recovered.

(11) *Results.*— In one case (No. 12) the result is not known. Of the other nineteen, seventeen recovered, and only two died, one on the day of the operation, presumably from shock, the other on the twelfth day, from sepsis.

(12) *Conclusions:*

a. Both experiments on animals and operation on man have shown that tumors of the liver, and even large portions of the liver itself, can be removed without undue disturbance of the function of the liver; the experimental evidence makes it probable that the liver-tissue may be regenerated and the loss made good.

b. That the escape of bile into the peritoneal cavity is not a usual phenomenon after such an operation; that it may generally be prevented either by searing the raw surface of the liver, by ligation, or by securing the stump in the abdominal wound, and that, even if the bile so enters the peritoneal cavity, the result is not necessarily fatal.

c. Hæmorrhage need not be greatly feared. The vessels can often be tied separately or in mass, or cut through by the cautery, or controlled by pressure, or by a combination of these means.

d. The resection or amputation is best done by enucleation, by the cautery or by the knife or scissors, preferably perhaps in the order named. In case of a tumor with a very large base of attachment, the operation may be done in two stages, the base being surrounded by an elastic ligature in the interval.

e. The mortality thus far has been only about ten per cent.

⁷ Lancet, 1891, i, 1091.

